JAPAN

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JIS B 9714 (2006) (English): Safety of machinery
-- Prevention of unexpected start-up

ISO INSIDE

安 全

The citizens of a nation must honor the laws of the land.

Fukuzawa Yukichi

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JAPANESE
INDUSTRIAL
STANDARD

Translated and Published by
Japanese Standards Association

JIS B 9714 : 2006

(ISO 14118 : 2000)

(JMF)

Safety of machinery–Prevention of unexpected start-up

ICS 13.110

Reference number : JIS B 9714 : 2006 (E)

Date of Establishment: 2006-11-25

Date of Public Notice in Official Gazette: 2006-11-27

Investigated by: Japanese Industrial Standards Committee

Standards Board

Technical Committee on Industrial Machinery

JIS B 9714: 2006, First English edition published in 2007-10

Translated and published by: Japanese Standards Association
4-1-24, Akasaka, Minato-ku, Tokyo, 107-8440 JAPAN

In the event of any doubts arising as to the contents,
the original JIS is to be the final authority.

Printed in Japan SW

Contents

Foreword

This translation has been made based on the original Japanese Industrial Standard established by the Minister of Health, Labour and Welfare and the Minister of Economy, Trade and Industry through deliberations at the Japanese Industrial Standards Committee according to the proposal of establishing a Japanese Industrial Standard from The Japan Machinery Federation (JMF), with a draft of Industrial Standard based on the provision of Article 12 Clause 1 of the Industrial Standardization Law.

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Safety of machinery–Prevention of unexpected start-up

Introduction

This Japanese Industrial Standard has been prepared based on the first edition of ISO 14118 *Safety of machinery–Prevention of unexpected start-up* published in 2000 without modifying the technical contents.

The portions underlined with dots are the matters not stated in the original International Standard.

Keeping a machine in a stopped condition while persons are present in danger zones is one of the most important conditions of the safe use of machinery and hence one of the major aims of the machine designer and machine user.

In the past, the concepts of "operating machine" and "stopped machine" were generally unambiguous; a machine was:

- operating when its movable elements, or some of them, were moving;
- stopped when its movable elements were at rest.

Machine automation has made the relationship between "operating" and "moving" on the one hand and "stopped" and "at rest" on the other hand, more difficult to define. Automation has also increased the potential for unexpected start-up, and a significant number of accidents have occurred where machines, stopped for diagnostic work or corrective actions, started up unexpectedly.

Hazards other than mechanical hazards generated by movable elements (e.g. from a laser beam) also need to be taken into account.

The risk assessment relating to the presence of persons in a danger zone of a stopped machine needs to take into account the probability of an unexpected start-up of the hazard-generating elements.

This Standard provides machine designers and machinery safety standard technical committees with a survey of built-in measures which can be used to prevent unexpected start-up.

1 Scope

This Standard specifies designed-in means aimed at preventing unexpected machine start-up (see 3.2) to allow safe human interventions in danger zones (see Annex A).

This Standard applies to unexpected start-up from all types of energy source, i.e.:

- power supply, e.g. electrical, hydraulic, pneumatic;
- stored energy due to, e.g., gravity, compressed springs;
- external influences, e.g. from wind.

NOTE: The International Standard corresponding to this Standard is as follows.

ISO 14118:2000 *Safety of machinery–Prevention of unexpected start-up* (IDT)

In addition, symbols which denote the degree of correspondence in the contents between the relevant International Standard and JIS are IDT (identical), MOD (modified), and NEQ (not equivalent) according to ISO/IEC Guide 21.

2 Normative references

The following standards contain provisions which, through reference in this text, constitute provisions of this Standard. If the indication of the year is given to the referred standard, only the edition of indicated year constitutes the provision of this Standard but the revision and amendment made thereafter do not apply.

JIS B 9700-1:2004 *Safety of machinery–Basic concepts, general principles for design–Part 1: Basic terminology, methodology*

NOTE: Corresponding International Standard: ISO 12100-1:2003 *Safety of machinery–Basic concepts, general principles for design–Part 1: Basic terminology, methodology* (IDT)

JIS B 9700-2:2004 *Safety of machinery–Basic concepts, general principles for design–Part 2: Technical principles*

NOTE: Corresponding International Standard: ISO 12100-2:2003 *Safety of machinery–Basic concepts, general principles for design–Part 2: Technical principles* (IDT)

JIS B 9702:2000 *Safety of machinery–Principles of risk assessment*

NOTE: Corresponding International Standard: ISO 14121:1999 *Safety of machinery–Principles of risk assessment* (IDT)

JIS B 9960-1:1999 *Safety of machinery–Electrical equipment of machines–Part 1: General requirements*

NOTE: Corresponding International Standard: IEC 60204-1:1997 *Safety of machinery–Electrical equipment of machines–Part 1: General requirements* (MOD)

3 Terms and definitions

For the purposes of this Standard, the terms and definitions given in JIS B 9700-1:2004 and the following apply.

3.1 start-up , machine start-up

change from rest to motion of a machine or of one of its parts

NOTE: The definition includes functions other than motion, e.g. switch-on of a laser beam.

3.2 unexpected [unintended] start-up

any start-up caused by:

- a start command which is the result of a failure in, or an external influence on, the control system;
- a start command generated by inappropriate action on a start control or other parts of the machine as, e.g., a sensor or a power control element;
- restoration of the power supply after an interruption;
- external/internal influences (gravity, wind, self-ignition in internal combustion engines, etc.) on parts of the machine.

NOTE: Start-up by the normal operation of automatic machinery is not to be considered as unintended start-up, but can be considered to be unexpected from the point of view of the operator. Prevention of accidents in this case involves the use of safeguarding measures (see JIS B 9700-2:2004, clause 5).

(based on JIS B 9700-1:2004, 3.29)

3.3 isolation and energy dissipation

procedure which consists of all of the four following actions:

a) isolating (disconnecting, separating) the machine (or defined parts of the machine) from all power supplies;

b) locking (or otherwise securing), if necessary (for instance in large machines or in installations), all the isolating units in the "isolated" position;

c) dissipating or restraining [containing] any stored energy which may give rise to a hazard.

NOTE: Energy considered in c) above may be stored in e.g.:

- mechanical parts continuing to move through inertia;
- mechanical parts liable to move by gravity;
- capacitors, accumulators;
- pressurized fluids;
- springs.

d) verifying by using a safe working procedure that the actions taken according to a), b) and c) above have produced the desired effect.

3.4 machine actuator

driving mechanism which actuates the machine (see JIS B 9960-1:1999, 3.32)

4 General requirements

4.1 Isolation and energy dissipation

Machines shall be provided with means intended for isolation and energy dissipation (see clause 5), especially with a view to major maintenance, work on power circuits and decommissioning in accordance with the essential safety requirement (see NOTE).

NOTE: For energy isolation, the requirement is described in ISO/TR 12100-2:1992, Annex A.1.6.3. The provision (" ") is shown as reference.

"Measures for isolating the machine from every power supply shall be given to all machines and such isolating devices shall be clearly identifiable. If reconnection gives rise to a hazard to exposed persons, they shall be locked. In the case of machine with the attachment plug, simply disconnect the plug. If it is not possible to check the energy isolation from any position where the operators can come close, isolating devices shall be locked. Any energy remained or stored in circuits of machines after energy isolation shall be properly dissipated without any risk to exposed persons.

With this exception, some circuits may be allowed to be connected to the energy source for the purpose of retention of parts, protection of information, interior lighting, etc. In this case, special measures shall be taken to secure safety of operators."

4.2 Other means to prevent unexpected [unintended] start-up

If the use of isolation and energy dissipation is not appropriate (e.g. for frequent short interventions), the designer shall provide, according to the risk assessment in accordance with **JIS B 9702**, other measures (see clause **6**) to prevent unexpected start-up. Additional means such as signalling and/or warning may be appropriate (see Annex B).

NOTE 1 Examples of tasks which can require the presence of persons in danger zones are given in Annex A.

NOTE 2 The designer should determine as completely as possible the different machine operating modes and the need for the presence of persons in danger zones. Appropriate safety measures can then be provided. These measures should prevent operators from being induced to use hazardous operating modes and hazardous intervention techniques caused by technical difficulties in the use of the machine (see **JIS B 9700-1**:2004, 3.22).

5 Means for isolation and energy dissipation

5.1 Devices for isolation from power supplies

5.1.1 Isolation devices shall:

- ensure a reliable isolation (disconnection, separation);
- have a reliable mechanical link between the manual control and the isolating element(s);
- be equipped with clear and unambiguous identification of the state of the isolation device which corresponds to each position of its manual control (actuator).

NOTE 1 For electrical equipment, a supply disconnecting device complying with **JIS B 9960-1**:1999, **5.3** "Supply disconnecting (isolating) device" meets this requirement.

NOTE 2 Plug and socket systems (for electrical supplies), or their pneumatic,

hydraulic or mechanical equivalents, are examples of isolating devices with which it is possible to achieve a visible and reliable discontinuity in the power supply circuits. For electrical plug/socket combinations, see **JIS B 9960-1**:1999, **5.3.2 d)**.

NOTE 3 For hydraulic and pneumatic equipment, see also **EN 982**:1996, **5.1.6** and **EN 983**:1996, **5.1.6**. The provision (" ") is shown as reference.

5.1.6 Hydraulic equipment in EN 982: 1996

"In order to prevent the unexpected start-up, the equipment shall be designed to isolate from energy resources properly and dissipate fluid pressure in the system without trouble.

Pneumatic equipment shall be as follows.

– appropriate isolation of supplies by isolating devices (locking may be necessary)

– isolating devices with pressure reduction mechanism (locking may be necessary)

– removal or support of mechanical load in the case of reducing pressure on the system

– isolation of power supplies"

5.1.6. Pneumatic equipment in EN 983: 1996

"In order to prevent unexpected start-up, the equipment shall be designed to isolate from energy resources and dissipate fluid pressure in the system without trouble.

Hydraulic equipment shall be as follows.

– automatic locking of isolating valves in the isolated position and dissipation of pressure of hydraulic equipment

– isolation of power supplies

When resupplying after isolation or reducing pressure, precautionary measures shall be necessary."

5.1.2 The location and number of isolation devices will be determined by the configuration of the machine, the need for the presence of persons in danger zones and the risk assessment. Each isolation device shall be readily identifiable as to which machine, or part of it, it isolates (e.g. by durable marking where necessary).

NOTE: For electrical equipment of machinery, see also **JIS B 9960-1**:1999, **5.4**.

5.1.3 When, during isolation of the machine, certain circuits have to remain connected to their power supply in order, e.g., to hold parts, protect information or provide local lighting, special means shall be provided to ensure operator safety.

NOTE: Such means include enclosures which can be opened only with a key or a special tool, warning labels and/or warning lights.

5.2 Locking [securing] devices

The isolation devices shall be capable of being locked or otherwise secured in the "isolated" position.

NOTE: Locking devices may not be necessary when a plug/socket combination is used and the plug can be kept under immediate supervision of the person present in the danger zone.

Locking devices include:

- facilities to apply one or more padlocks;
- trapped-key interlocking devices (see **JIS B 9710**:2006, Annex E), one of the locks of which is associated with the manual control [actuator] of the isolating device;
- lockable housings or enclosures.

Locking devices are not required when reconnection cannot endanger persons.

5.3 Devices for stored-energy dissipation or restraint [containment]

5.3.1 General

5.3.1.1 Devices for stored-energy dissipation or restraint [containment] shall be incorporated into the machine where stored energy can give rise to a hazard.

NOTE: Such devices include brakes intended to absorb kinetic energy of moving parts, resistors and relevant circuitry to discharge electrical capacitors, valves or similar devices to depressurize fluidic accumulators (see NOTE 3 to **5.1.1**).

5.3.1.2 When dissipation of stored energy would excessively reduce the ability of the machine to be used, additional means shall be incorporated to reliably restrain or contain the remaining stored energy.

5.3.1.3 The devices for energy dissipation or restraint [containment] should be selected and arranged so that:

- dissipation or restraint [containment] results from the isolation of the machine (or part of it);
- the energy dissipation process does not give rise to hazardous situations.

5.3.1.4 The necessary procedures for energy dissipation or restraint [containment] shall be described in the instruction handbook of the machine or in warnings on the machine itself.

5.3.2 Mechanical elements

When mechanical elements can give rise to a hazardous situation

- by virtue of their mass and position (e.g. unbalanced, or raised, or in any situation where they could move under the effect of gravity),

– or as a result of the action upon them of spring load (whatever this "spring" is made of),

means shall be provided to bring them to the lowest energy state (e.g. lowest position or spring-relaxed) either by the usual machine manual controls or by devices specifically designed and identified (marked) for that function.

When the mechanical elements cannot be brought into an intrinsically safe state, they shall be mechanically secured by brakes or mechanical restraint devices in accordance with JIS B 9700-1:2004, 3.26.7.

5.3.3 Locking or securing facilities for the restraint [containment] devices

The devices for energy restraint [containment] shall whenever necessary be capable of being locked or otherwise secured.

5.4 Verification

5.4.1 General

The machine and the isolation and energy dissipation or restraint [containment] devices shall be designed, selected and arranged so that reliable verification of the effectiveness of the isolation and energy dissipation or restraint [containment] can be carried out.

Provisions to verify the effectiveness of the isolation, energy dissipation and restraint [containment] measures shall not impair their effectiveness.

5.4.2 Provisions for verifying isolation

Isolation from any power supply shall either be visible (visible break in the power supply circuits) or indicated by an unambiguous position of the manual control (actuator) of the isolating device.

NOTE: See also **5.1.1** relating to the mechanical link between the isolating element(s) and the manual control.

5.4.3 Provisions for verifying energy dissipation or restraint [containment]

5.4.3.1 Built-in devices (such as pressure gauges) or test points shall be provided for verifying the absence of energy in parts of a machine in/on which interventions are intended.

5.4.3.2 The instruction handbook (see JIS B 9700-2:2004, 6.5) shall provide precise guidance on safe verification procedures.

5.4.3.3 Permanent labels shall be fixed to assemblies, warning against hazards due to stored energy (e.g. compressed springs) where assemblies can be removed or dismantled.

6 Measures, other than isolation and energy dissipation, to prevent unexpected start-up

6.1 Design strategy

For every application where isolation and energy dissipation are not appropriate for all interventions, the designer shall decide, in accordance with the risk assessment, the measures (among those listed below) considered necessary to prevent unexpected start-up. These are given as follows:

- measures (component design, selection and location) to prevent accidental generation of start commands from external or internal influences in any part of the machine (see 6.2);
- measures, dependent on the system architecture/structure, provided to prevent accidental start commands resulting in an unexpected start-up (see 6.3);
- means automatically stopping the hazard-generating part of the machine before a hazardous situation can arise from an unexpected/unintended start-up of this part (see 6.4).

The selected measures shall not be considered to be a substitute for the measures for isolation and energy dissipation set out in clause 5.

NOTE: The selected measures will in most cases be a combination of the different measures described in this clause.

6.2 Measures to prevent accidental generation of start commands

6.2.1 Measures to prevent accidental actuation of (manual) start controls

Accidental actuation of (manual) start controls, as well as unexpected results from actuating these devices (e.g. start-up of a machine other than the expected one, or initiation of a movement in a wrong direction), shall be prevented by appropriate design, location, protection and marking of (manual) start controls [actuators]. The expected results/effects of actions on start controls shall be made clear, e.g. by use of indication means (see also first paragraph of Annex B), in cases where lack of such information can endanger persons.

NOTE 1 Guidance is given in JIS B 9700-2:2004, 4.11.8, JIS B 9706-1:2001 and JIS B 9706-2:2001.

NOTE 2 Other examples of measures to prevent unauthorized/unintended start-up are locking of start manual controls, passwords in programmable control systems.

6.2.2 Design of safety-related parts of data storage and processing equipment

The safety-related parts of the data storage and processing equipment (see figure 1) shall be designed, and their components selected, so that the probability of this equipment generating start commands which may lead to an unexpected start-up, when it is taken into account in the risk assessment carried out in accordance with JIS B 9702,

can be considered to be sufficiently low.

NOTE 1 Guidance is given in:

- JIS B 9700-2:2004, 4.11
- JIS B 9960-1:1999, especially clauses 9 and 11.

See also JIS B 9705-1:2000.

NOTE 2 Where programmable electronic systems are used for the control of machinery, it is believed at present that it is difficult to determine, with any degree of certainty in situations where a significant hazard can occur due to the maloperation of the control system, that reliance on correct operation of a single channel of programmable electronic equipment can be assured. Until this situation can be resolved, it is inadvisable to rely solely on the correct operation of such a single channel device (see JIS B 9960-1:1999, NOTE to 11.3.4).

6.2.3 Selection and location of power control elements

Power control elements (e.g. contactors, valves: see figure 1) shall be selected and/or applied so that they cannot change their state under the effect of external influences (such as vibration or shocks of the highest expected value within intended conditions of use) or of disturbances of the power supply (such as pressure or voltage fluctuations within defined tolerances).

Power control elements shall, if necessary (especially if they can be manually operated), be located in an enclosure to prevent their unauthorized or unintended actuation.

6.3 Measures to prevent accidental start commands resulting in unexpected start-up

6.3.1 Principle

Maintained stop commands are introduced, separately or in combination, in the machine at different "levels" (see figure 1). These can be generated either by stop control devices (see 6.3.2) or by safety [protective] devices (see 6.3.3). Mechanical disconnection (see 6.3.4) or moving-part immobilization (see 6.3.5) may be used instead of, or in addition to, maintained stop commands.

An accidental start command should not result in machine start-up if it is generated by/in a machine component placed above the level at which a maintained stop command has been introduced (level A, B or C), or if mechanical disconnection (level D) or moving-part immobilization (level E) has been achieved (see figure 1).

6.3.2 Input, at level A, B or C (see figure 1), of a maintained stop command generated by a stop control device

To prevent unexpected [unintended] start-up due to accidental generation of start commands (including those generated within the control system itself), the stop manual control (or the stop control device) can be secured in the OFF/STOP condition, pro-

vided that the control system is designed so that the stop commands from the stop control device have priority over the start commands in accordance with the essential safety requirement (see NOTE). Securing in the OFF/STOP condition can be achieved by means of:

- a latching-in or key-operated stop control device which applies a maintained stop command until the device is reset manually;
- a lockable selector switch with a reliable and unambiguous indication of position which applies a maintained stop command until the switch is manually reset;
- a lockable cover which, when locked closed, forces the stop manual control into the OFF/STOP condition. If this cover also prevents access to the start manual control, accidental operation of this start control is prevented;
- a movable guard which, from the very beginning of its opening stroke, forces the stop manual control into the OFF/STOP condition. If the movable guard also prevents access to the start manual control, accidental operation of this start control is prevented.

Criteria for the design and selection of the securing means suitable for the intended application are:

- unambiguity, i.e. clear and unambiguous indication when the device is in the OFF/STOP condition;
- reliability, as far as the ability of the device to remain in the OFF/STOP condition is concerned.

Where a stop control is provided with a securing device to retain it in the OFF/STOP condition, removal of the securing device shall not by itself cause a restart command.

NOTE: For stopping devices the requirement is described in ISO/TR 12100-2:1992, Annex A.1.2.4. The provision (" ") is shown as reference.

1) Regular stop: Each machine shall be equipped with the control which can migrate to the state of complete stop. Each workstation shall be equipped with the control which stops a part and/or all of operating parts of the machine and migrates to the safe state. If the machine or the dangerous part is stopped, energy supplies to the actuator shall be isolated.

2) Emergency stop

Each machine shall be equipped with one or more emergency stop devices to avoid present or imminent danger.

There are exceptions.

- Machines in which risk is not reduced by the emergency stop device due to either case that the device does not shorten stopping time or special measures necessary for treating risks can not be taken.
- Portable machines and hand-held machines

The emergency stop device shall be as follows.

- It shall be clearly identifiable, visible and promptly accessible.
- It shall stop dangerous processes as soon as possible to prevent generating new danger.
- If necessary, the particular safeguarding device shall start to operate or the operation shall be allowed.

The emergency stop control shall remain as being connected. The connection shall be able to be deactivated only by appropriate operation. The machine shall not be restarted and be only given permission of restart by deactivation of control. The stop control shall not start the stopping mechanism before being in the position of connection.

3) Combined machines: For the machine or a part of the machine designed to function as an assembly the stop control devices shall be designed by the manufacturer to stop not only the machine but also all devices in the higher level side and/or the lower level side if continuation of operation may give rise to a danger."

6.3.3 Input, at level A, B or C (see figure 1), of a maintained stop command generated by a safety [protective] device

To prevent operation of a machine (from whatever cause, including unexpected start-up) when a person is in a danger zone, a safety [protective] device or combination of safety [protective] devices can be selected. The permanent stop command it generates shall be introduced at the appropriate level (see figure 1), in accordance with the risk assessment (see **JIS B 9702**).

NOTE: Standards giving guidance include:

- **JIS B 9700-2**:2004, **5.2**;
- **JIS B 9710**:2006, dealing with interlocking devices associated with guards.
- **ISO 13856-1**, dealing with pressure-sensitive mats and floors.
- **ISO 13856-2**:2005, dealing with pressure-sensitive edges and bars.
- **ISO/DIS 13856-3**, dealing with pressure-sensitive bumpers, plates, wires and similar devices.
- **JIS B 9704-1**:2000 and **JIS B 9704-2**:2000, dealing with electro-sensitive protective equipment.

(see Bibliography)

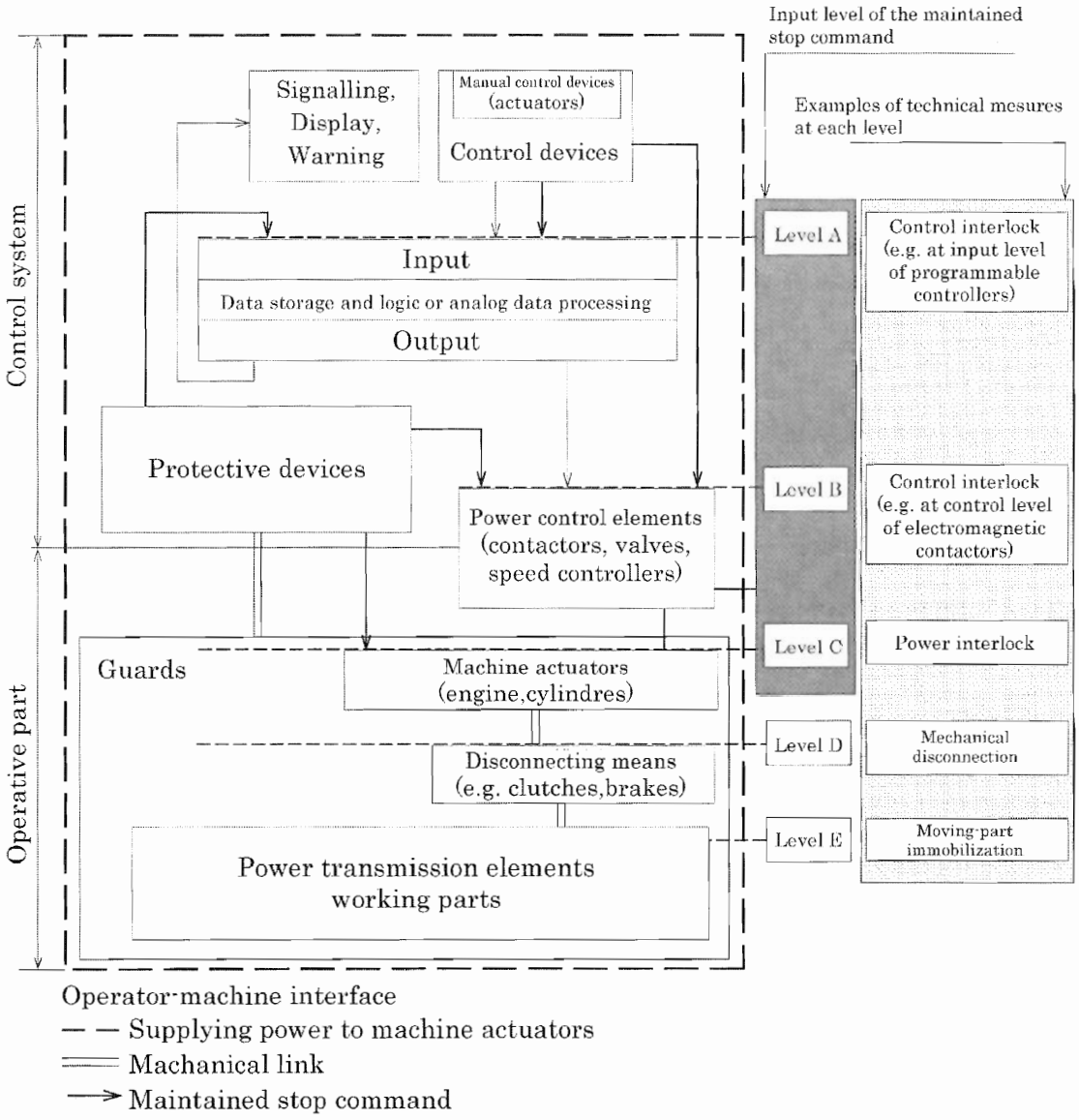

Figure 1 Application of measures, other than isolation and energy dissipation, to prevent accidental start commands resulting in unexpected start-up

6.3.4 Mechanical disconnection (level D)

Mechanical disconnecting devices, e.g. clutches, shall be designed, selected and used, and where necessary monitored, so that the separation from machine actuators is ensured.

6.3.5 Moving-part immobilization (level E)

When a moving part is immobilized by means of a mechanical restraint device (see for example **JIS B 9700-1**:2004, **3.26.7**), e.g. a wedge, spindle, strut, scotch, which is an integral part of the machine, the mechanical strength of this mechanical restraint de-

vice shall be sufficient to withstand the forces resulting from start-up of the machine.

Where this is not practicable and mechanical immobilization is needed to prevent, for instance, movement of parts under the influence of gravity, or if starting up the machine actuators with immobilized moving parts can damage the machine or generate risk for persons in its vicinity, an interlocking device operating at level B or C shall prevent the machine from starting up as long as the mechanical restraint device immobilizes the moving parts.

6.4 Automatic monitoring of the category 2 stopped condition

When a machine is at rest as a result of a category 2 stop as defined in JIS B 9960-1:1999, 9.2.2, any accidental start command could give rise to an unexpected start-up.

If other measures to prevent unexpected start-up are not practicable, one method is to monitor the stopped condition and to arrange for a category 0 stop to be initiated as soon as the conditions for (or the beginning of) an unexpected start-up are detected.

Annex A (informative)

Examples of tasks which can require the presence of persons in danger zones

This Annex (informative) is to supplement the matters related to the text and not to constitute the provisions of this Standard.

- inspection;
- corrective actions (clearing blockages, etc.);
- setting, adjustment;
- manual loading/unloading;
- tool change;
- lubrication;
- cleaning;
- decommissioning;
- minor maintenance/repair;
- diagnostic, testing;
- work on power circuits;
- major maintenance (works requiring significant dismantling).

Annex B (informative)

Signalling and warning

This Annex (informative) is to supplement the matters related to the text and not to constitute the provisions of this Standard.

The results/effects of the action on manual controls are more easily foreseen and understood when the machine is fitted with signalling [indicating] devices giving information on the different states (e.g. "power on", "waiting for a start command", "program running", "failure", "waiting for material feeding") and on the different possible modes of control and of operation of the machine (see **JIS B 9706**-1:2000 and **JIS B 9706-2**:2001).

When it is not practicable to see all danger zones from the operator control station, and when the presence of persons in danger zones cannot be absolutely excluded, an audible warning signal (see **ISO** 7731:1986 and **JIS B 9706**-1:2001 and **JIS B 9706-2**:2001) is initiated for a sufficient time before machine start-up to enable those persons either to leave the danger zone or to prevent the machine starting, e.g. by actuating an emergency stop device.

Bibliography

[1] ISO 7731:1986 *Danger signals for work places–Auditory danger signals*

[2] ISO 13856-1:2001 *Safety of machinery–Pressure-sensitive protective devices–Part 1: General principles for design and testing of pressure-sensitive mats and pressure-sensitive floors*

[3] ISO 13856-2:2005 *Safety of machinery–Pressure-sensitive protective devices–Part 2: General principles for the design and testing of pressure-sensitive edges and pressure-sensitive bars*

[4] ISO/DIS 13856-3 *Safety of machinery–Pressure-sensitive protective devices–Part 3: General principles for the design and testing of pressure-sensitive bumpers, plates, wires and similar devices*

[5] JIS B 9705-1: 2000 *Safety of machinery–Safety-related parts of control systems–Part 1: General principles for design*

NOTE: Corresponding International Standard: ISO 13849-1:1999 *Safety of machinery–Safety-related parts of control systems–Part 1: General principles for design* (IDT)

[6] JIS B 9710:2006 *Safety of machinery–Interlocking devices associated with guards–Principles for design and selection*

NOTE: Corresponding International Standard: ISO 14119:1998 *Safety of machinery–Interlocking devices associated with guards–Principles for design and selection* (IDT)

[7] JIS B 9706-1:2001 *Safety of machinery–Indication, marking and actuation–Part 1: Requirements for visual, auditory and tactile signals*

NOTE: Corresponding International Standard: IEC 61310-1:1995 *Safety of machinery–Indication, marking and actuation–Part 1: Requirements for visual, auditory and tactile signals* (IDT)

[8] JIS B 9706-2: 2001 *Safety of machinery–Indication, marking and actuation–Part 2: Requirements for marking*

NOTE: Corresponding International Standard: IEC 61310-2:1995 *Safety of machinery–Indication, marking and actuation–Part 2: Requirements for marking* (IDT)

[9] JIS B 9704-1: 2000 *Safety of machinery–Electro sensitive protective equipment–Part 1: General requirements and tests*

NOTE: Corresponding International Standard: IEC 61496-1: 1997 *Safety of machinery–Electro-sensitive protective equipment (ESPE)–Part 1: General requirements and tests* (MOD)

[10] JIS B 9704-2:2000 *Safety of machinery–Electro-sensitive protective equipment–Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)*

NOTE: Corresponding International Standard: IEC 61496-2: 1997 *Safety of machinery–Electro-sensitive protective equipment (ESPE)–Part 2: Particular requirements for equipment using active opto-electronic protective devices (AOPDs)* (IDT)

[11] EN 982: 1996 *Safety of machinery–Safety requirements for fluid power systems and their components–Hydraulic*

[12] EN 983: 1996 *Safety of machinery–Safety requirements for fluid power systems and their components–Pneumatic*

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